INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

LJS-13A SERIES

LAMBDA

LAMBDA ELECTRONICS–MELVILLE, L. I., N. Y.

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FOR

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This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LJS-13A models unless otherwise specified.

LAMBDA ELECTRONICS MELVILLE, L.I. N.Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

B - 1288

IM-LJS-13A

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SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I
VOLTAGE AND CURRENT RANGES

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE		
		50° C	60° C	71° C
LJS-13A-5-OV	5 ± 5%	10	7	4
LJS-13A-6-OV	6 ± 5%	8.5	6	3.4
LJS-13A-12-OV	12 ± 5%	5	3.5	2
LJS-13A-15-OV	15 ± 5%	4	2.8	1.6
LJS-13A-20-OV	20 ± 5%	3.5	2.5	1.4
LJS-13A-24-OV	24 ± 5%	3	2.1	1.2
LJS-13A-28-OV	28 ± 5%	2.5	1.8	1

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation	0.4% line or load with input variations from 105-132 or 132-105 volts AC and load variations from no load to full load.
Ripple and Noise	10mV RMS, 50mV peak-to-peak for LJS-13A-5-OV, -6-OV models; 15mV RMS, 100mV peak-to-peak for LJS-13A-12-OV, -15-OV, -20-OV, -24-OV, and -28-OV with either positive or negative terminal grounded.
Temperature Coefficient	Change in output voltage 0.03%/° C max.
Remote Programming	
External Resistor	Nominal 1000 ohms/volt output.
Programming Voltage	One-to-one voltage change.
Remote Sensing	Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

STORAGE TIME — 16 ms min. at full rated current, maximum rated output voltage, and 105 VAC input.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

INPUT

AC Input	105-132 VAC at 47-440 Hz. Input power: 71 Watts*. For operation at frequencies above 440 Hz, consult factory.

*With output loaded to full current rating.

DC Input	145 VDC ± 10%. Input power: 71 Watts†.

†With output loaded to full current rating.

INPUT FUSE — Fuse F1 protects the input wiring to the power supply. Overload of power supply does not cause fuse failure.

OVERLOAD PROTECTION

Electrical External	Automatic electronic current limiting circuit, limits output current to a preset safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.
Internal	Fuse F1 provides prevention against internal circuit failure.

OVERVOLTAGE PROTECTION — All LJS-13A models include fixed built-in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage. See table below for overvoltage protector firing ranges.

MODEL	OVERVOLTAGE PROTECTOR TRIP-POINT RANGE (VOLTS)
LJS-13A-5-OV	6.3 — 6.9
LJS-13A-6-OV	7.1 — 7.7
LJS-13A-12-OV	13.3 — 14.3
LJS-13A-15-OV	16.5 — 17.5
LJS-13A-20-OV	22.1 — 23.5
LJS-13A-24-OV	26.5 — 28.1
LJS-13A-28-OV	30.9 — 32.9

INPUT AND OUTPUT CONNECTIONS — Terminal block on front of chassis. Reed-Prince no. 2 screwdriver is required for terminal screws.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE (non operating) — -55° C to +85° C

VDC ADJ. Control — Voltage adjust control permits adjustment of DC output over entire operating range.

GUARANTEE — 5 year guarantee from date of shipment . . . materials and labor.

PHYSICAL DATA

Size	1-11/16" x 4-17/32" x 7-13/64"
Weight	1.6 lbs. net
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING — One surface with tapped mounting holes can be utilized for mounting this unit. All LJS-13A power supplies must be mounted with top facing up and in a horizontal plane. Refer to figure 10 for mounting details.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 50°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, voltage decreases towards zero and the current at short circuit is held to a safe value.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block on the front of the supply. Use a Reed-Prince no. 2 screwdriver on terminal screws. Apply input power to input terminals; always connect the ungrounded AC or DC lead to the bottom terminal.

The supply positive terminal is brought out to terminal +V. The supply negative terminal is brought out to terminal -V. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the front output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at a nominal 1000 ohms/volt change and a shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will nominally be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of the programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 1.1ma. minimum.

Alternatively, when supplies with less than 1.1ma. reverse current capability are used, a resistor capable of drawing 1.1ma. at the minimum programming voltage must be connected across the output terminals of the programming supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7.

The voltage capability of LJS-13A power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of SPECIFICATIONS AND FEATURES, for power supply current and voltage ratings.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Fuse Shutdown. Fuse will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Overvoltage Shutdown. When the power supply output voltage increases above the overvoltage limit, the overvoltage protection circuit will short circuit output of the supply and shut down inverter operation. After eliminating the cause(s) for overvoltage, resume operation of the supply by momentarily interrupting the AC input circuit.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on SPECIFICATIONS AND FEATURES for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before troubleshooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder.
2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.
3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.
4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.
5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:
   a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

b) Dip the wick in liquid rosin flux.

c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the no load to load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL VR2.

Whenever voltage and current indications do not reflect maximum ratings, adjust VR2 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stablized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of VR2 from resistor housing and turn to full CCW position.
3. Operate power supply for constant voltage with local sensing connected as shown in figure 3, with no external load, and with AC input of 132 VAC, 60 Hz.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 130-150% of 50°C rating for the unit.
6. Using a differential meter, DC DVM (John Fluke Model 891A or equivalent), observe output voltage while adjusting VR2 in CW direction. Adjust VR2 until output voltage drops.
7. After adjustment is completed, remove AC input power to the supply and reseal wiper of VR2.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not electronic part, or is not listed, provide a description, function, and location, of the part.

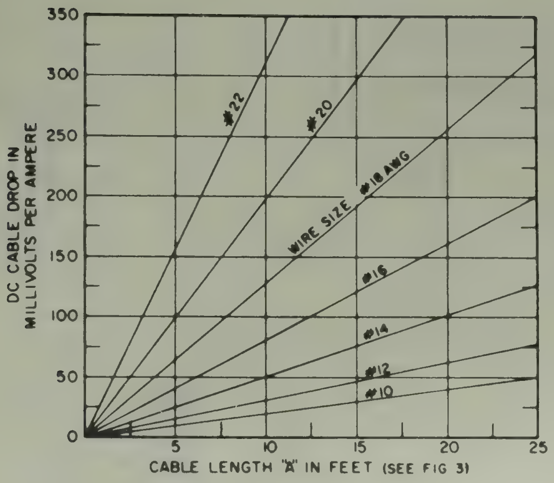


Figure 1. Cable Connection Chart.

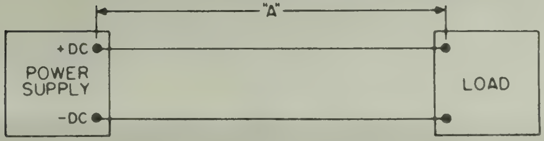
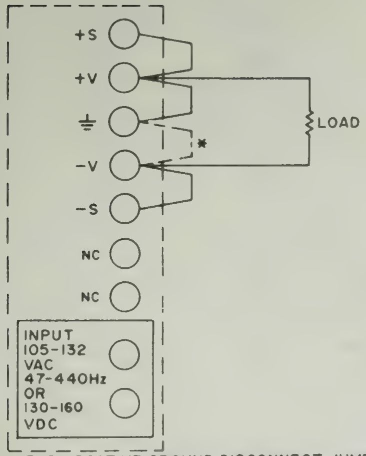
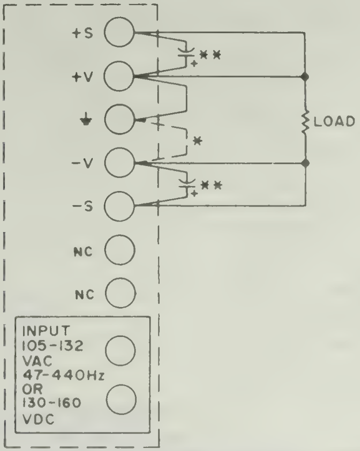


Figure 2. Cable Length "A" in Feet.



* FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS +V AND ⏚ AND RECONNECT TO −V AND ⏚

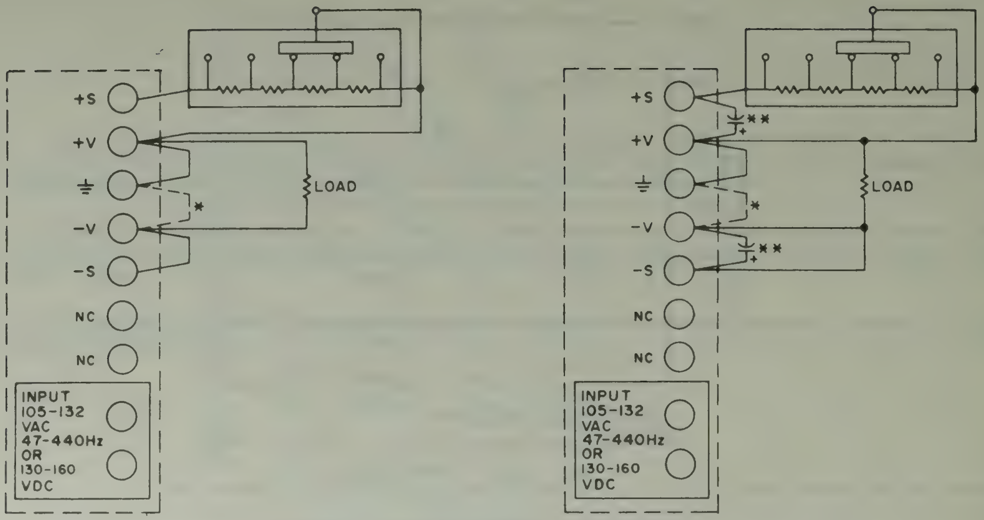
Figure 3. Local Sensing Connections.



* FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS +V AND ⏚ AND RECONNECT TO −V AND ⏚

** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.

Figure 4. Remote Sensing Connections.

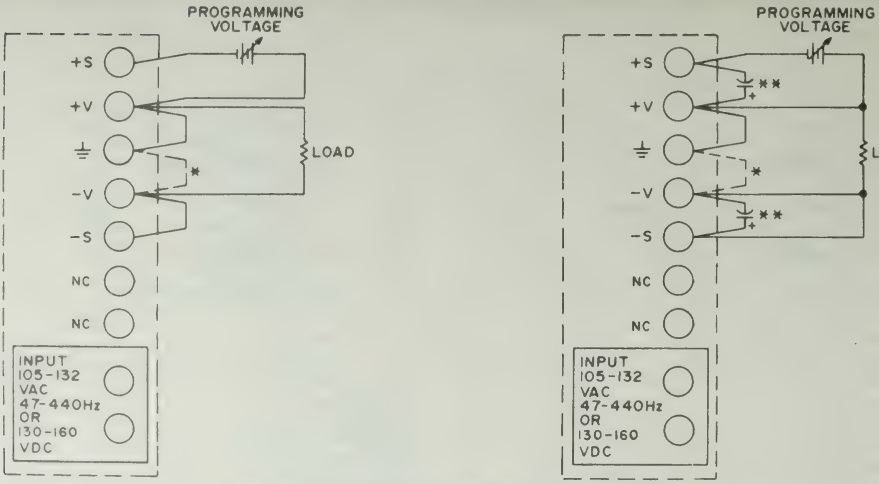


* FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS +V AND ⏚ AND RECONNECT TO −V AND ⏚.
** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

(A) LOCAL SENSING

(B) REMOTE SENSING

Figure 5. Programmed Voltage, With External Resistor.

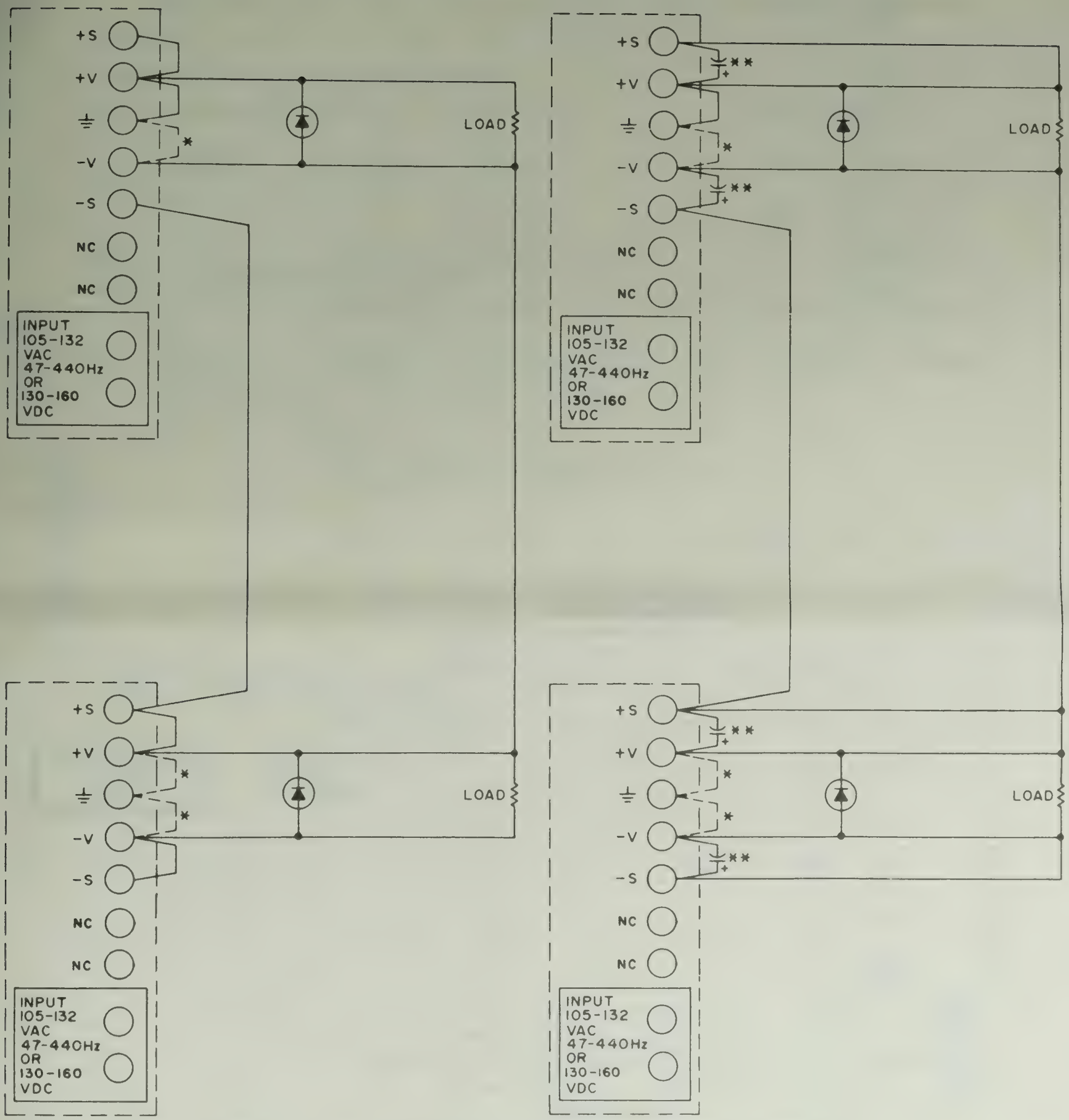


* FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS +V AND ⏚ RECONNECT TO −V AND ⏚.
** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

(A) LOCAL SENSING

(B) REMOTE SENSING

Figure 6. Programmed Voltage, With External Programming Voltage Source.



(A) LOCAL SENSING

(B) REMOTE SENSING

* MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS +V AND ⏚ ON TOP UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

* * A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.

Figure 7. Series Connection.

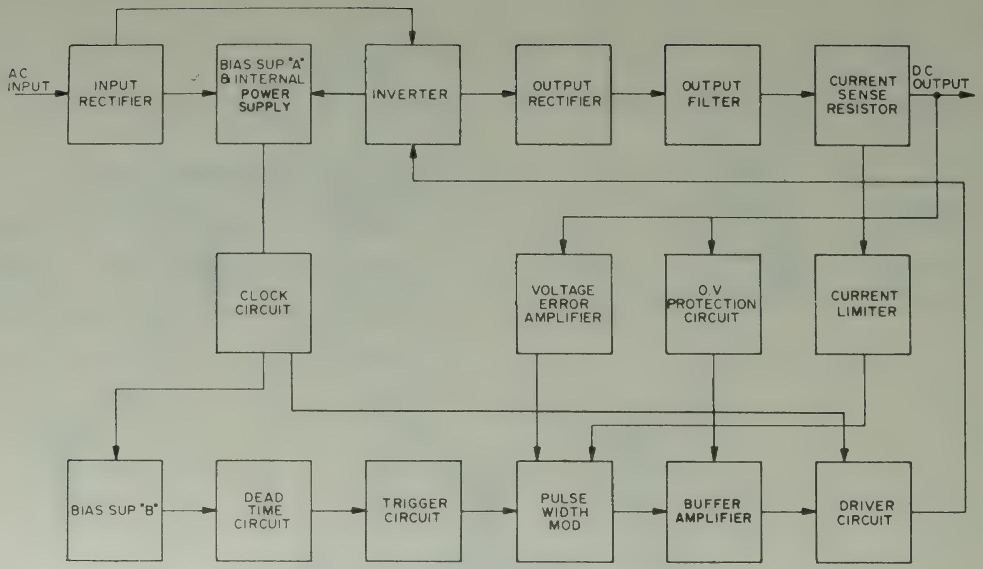
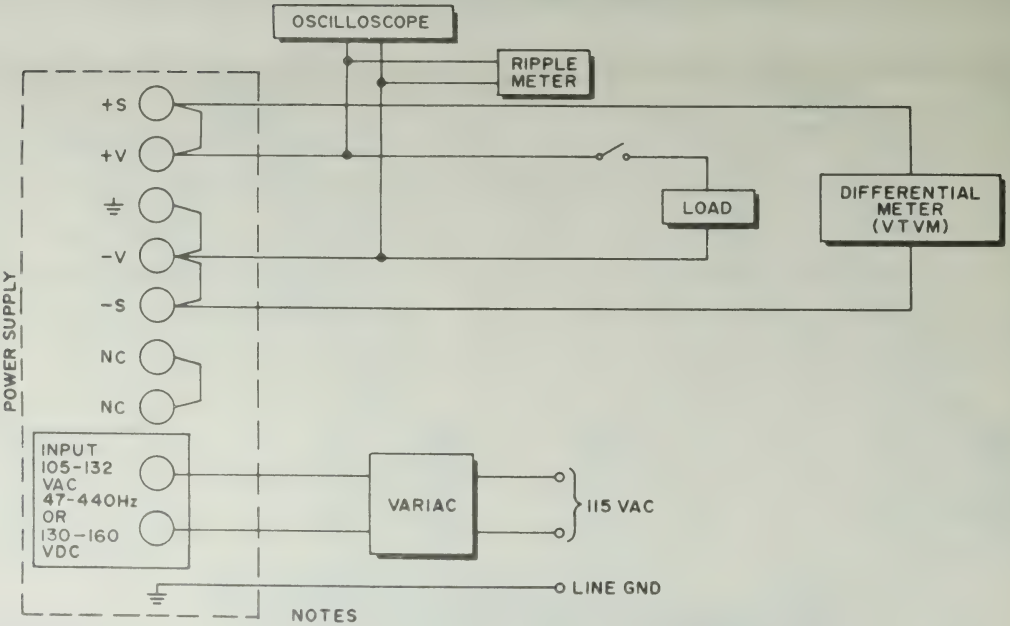
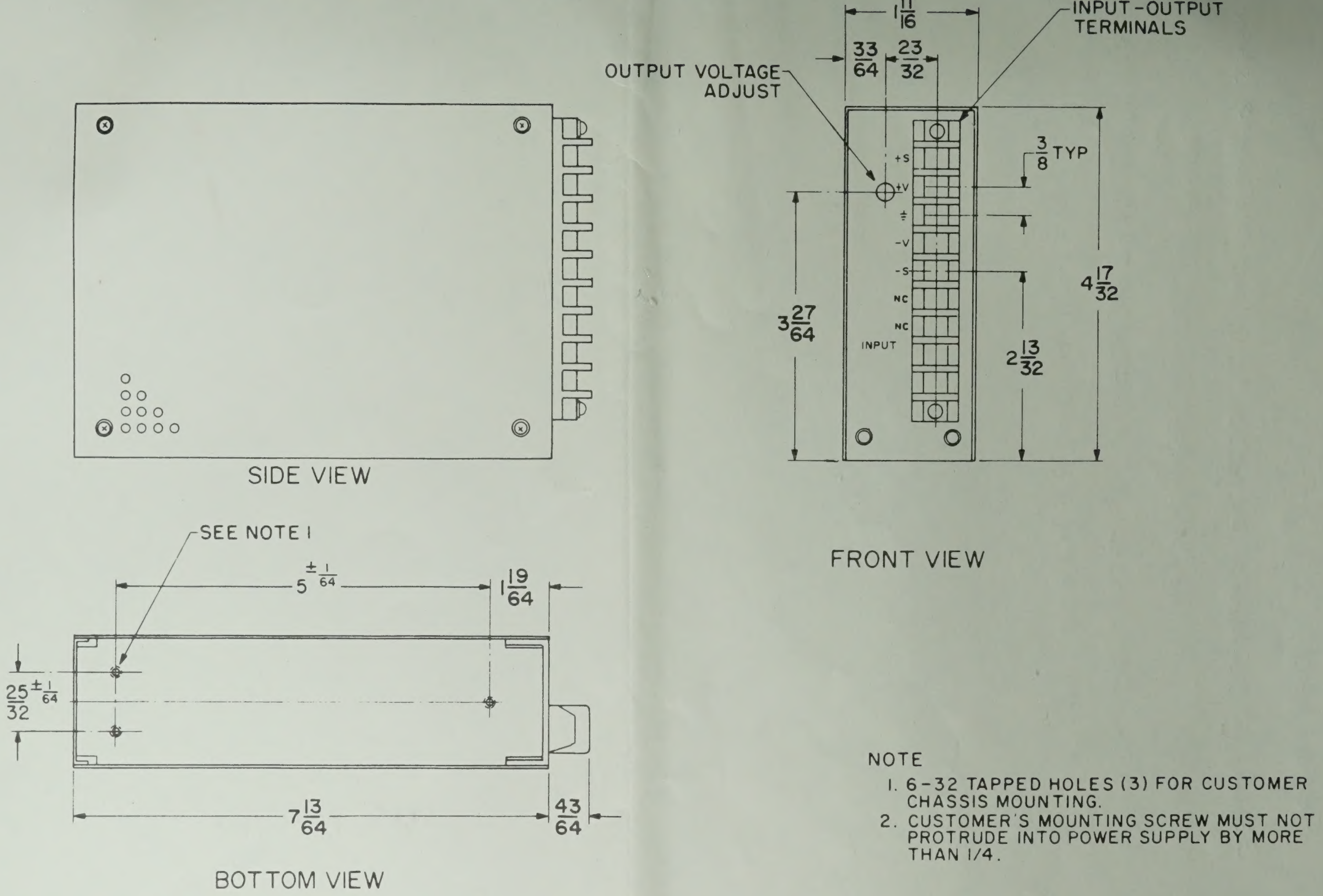


Figure 8. Typical Block Diagram.



NOTES
1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.

Figure 9. Test Connections for Performance Checks.



NOTE

1. 6-32 TAPPED HOLES (3) FOR CUSTOMER CHASSIS MOUNTING.
2. CUSTOMER'S MOUNTING SCREW MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 1/4.

Figure 10. Outline Drawing.

Repaired 10/4/05

3.3 µfd @ 35 WVDC across +/-V OUTPUT Lugs shorted. Replaced with 1.0 µfd @ 35 WVDC. If more Capacitance needed - place across OUTPUTS on terminal board externally.